SOME EARLY ENTOMOLOGICAL IDEAS AND PRACTICES IN AMERICA

By Harry B. Weiss

Early ideas and practices in any field should be considered in connection with the times in which they circulated. When viewed many years later, in the light of accumulated knowledge and wisdom, they frequently appear fanciful and unworkable. On the other hand some early workers and observers had ideas far in advance of their time and with the passage of years the soundness of their judgment has become apparent. The following examples, drawn from various records, are cited as early expressions of entomological thought and suggestion.

Occasionally, translations of foreign papers were published in our early scientific journals. One of these, entitled, "A Memoir on Animal Cotton, or the Insect Fly Carrier," by Baudry des Lozieres, founder of the Society of Sciences and Arts at Cape Francois, was read before the American Philosophical Society in 1797 (Trans. vol. 5, no. 18, p. 150–159). The author, in this paper, refers to a caterpillar that destroyed indigo and cassada plantations at Santo Domingo. He described the caterpillar, its food, mating of the adults, eggs, natural enemies, etc., but was particularly interested in the activities of an "ichneumon" parasite. Parsitized caterpillars changed color, increased in size and assumed a state of "factitious pregnancy." Lozieres described the cocoons of the parasite, but did not seem to be aware that the parasitic larvae had been feeding within the body of the host for he said, as soon as the larvæ were hatched, without moving from the spot where the eggs were laid, they yielded a liquid which hardened upon contact with air and then spun their cocoons. These cocoons fascinated him. He said they were made of the finest cotton and he called it cotton because it was "idio-electric" and was pervious to the "electric fluid." As soon as the parasites emerged, the cocoons could be carded and spun and in less than two hours it was possible to collect 100 pints of cocoons as they were always plentiful. Such "animal cotton" could also be used

in hospitals, as it did not inflame wounds like silk and vegetable cotton. Baudry des Lozieres believed that the use of such cocoons would introduce a new branch of commerce with the West Indian colonies and make useful an insect previously known for the trouble it caused. However, this new branch of commerce never developed. At the time the idea was suggested, commerce was uppermost in the minds of many persons and it is likely that proposals involving any increase in trade always received the most attention.

A posthumous paper on "Facts, Experiments, and Observations Relative to Some American Species of Lampyris, or Fireflies . . ." by Dr. Thomas Walmsley appeared in the Medical and Physical Journal in 1807 (vol. 2, pt. 1, Nov. 27, Suppl. 1, Mar. 7, Sect. 2, Art. 4, p. 118–123). Dr. Walmsley reported that when Lampyris was immersed in water, it drowned in fifteen to twenty minutes, but shone with almost as much brilliancy as when in the open air. Immersed in spirit of wine, it lived for five or six minutes, remained "opake" for two or three minutes, then flashed for three or four times, losing part of its opacity after each flash. In a perfect Torricellean vacuum it shone for a short time and then became "opake." Upon the admission of the least amount of air, it shone again. Walmsley tried carbonic acid gas, hydrogen, oxygenated muriatic acid gas, oxygen and azotic gas and noted their effects upon the luminosity of the beetle. He then described the part emitting the light and stated that the air taken in by the spiracula had no communication with the luminous part. He believed that the air came into contact with the "phosphorescent" substance some other way.

Numerous workers before and after Walmsley have been excited by luminous organisms and much investigational work has been done on the biology, physics and chemistry of such forms. It is now known that the light organs of fireflies consist of a dorsal mass of reflecting cells and a ventral mass of photogenic cells well supplied with tracheæ and nerves. It is in the photogenic layer that the substance luciferin is oxidized in the presence of an enzyme, luciferase, under the control of the nervous system. The brilliance of the flash is determined by the flow of air through the tracheæ and tracheoles.

Dr. Walmsley was born near Philadelphia in 1781. When nineteen he began the study of medicine at the University of Pennsylvania, receiving the degree of M.D. in 1803. He practiced in Chambersburg, Pa., and then in Elizabethtown, Md. During the years immediately preceding his death at the early age of 25, he was much interested in the light of fireflies and in the natural history of these insects.

About 1810 the idea must have prevailed that insect abundance and human disease went hand in hand because in order to combat this idea the "Medical Repository and Review of American Publications on Medicine, Surgery and the Auxiliary Branches of Philosophy," published in 1810 (vol. iv, p. 304–305) an unsigned statement entitled "Insects in Abundance not Necessarily Connected with Sickly Seasons," from which the following is quoted.

"In describing pestilential seasons, it has been very common to notice the innumerable swarms of insects. Some observers of the phenomena attendant on times of sickness have even been led to an opinion that the growth and multiplication of these tribes of animals is promoted by that condition of the atmosphere and the waters which is unfriendly to the health of man. We suspect, however, this is by no means correct. The summer and autumn of 1800 was very productive of insects in the states of New York, New Jersey & Pennsylvania and still no considerable degree of sickness occurred, either in city or country. Locusts were so thick in West Jersey and the eastern parts of Pennsylvania—as to keep up a continuous noise." Other cases are cited of numerous forest tree insects but no remarkeble human illnesses prevailed. "There is therefore no necessary connection between swarms of insects & pestilential seasons. But it is nevertheless true that during some periods of epidemic sickness, there have been great numbers of insects. These, however, have been merely accidntal coincidences & by no means indicate a law of nature on the subject. On the contrary—some insects are killed by pestilential air as has been often observed of common house-flies, vast numbers of which died on the approach of the sickness in New York toward the latter part of the summer of 1799. For the future, physicians & others who describe pestilential seasons, should be careful not to use the broad & unqualified term 'in-

sect'—but instead particularize the species which is abundant. This is the safest & will mean more to readers."

On October 10, 1810, the Rev. William Smith wrote a letter from Norwalk, Connecticut, to Doctor Mitchill, editor of the Medical Repository about "Observations on the Decay of Fruit Trees, and on Lean and Shriveled Fruit, as Caused by Insects," which was published in 1811 (vol. 14, no. 4, p. 350–354).

It appears that some peaches on exhibition in New York were destitute of pulp, juice and flavor. Some resemblance was traced between their external form and that of hickory nuts, and this led to a belief on the part of some that they represented a mongrel production. The Rev. Smith inquired into the facts, found that they came from the Moses Hanford orchard, of Canaan and concluded that the trouble was caused as follows: "Some fly, to which the apricot and nectarine trees are more accessible than others, injects its eggs or semina, which contaminate the juices of the tree so powerfully as to stop the fructification, at an earlier or later stage, according to the strength of the trees." The tree in question showed exudations of gum and numerous "insect incisions," and the fruit was dried and shriveled. Probably the trouble was due to the shot-hole borer, or to peach yellows or to "little-peach," or to all.

The Atlantic Monthly in 1832 (vol. 1, no. 1, p. 13–14) published an article by Constantine Samuel Rafinesque that does him no credit although at the time everything probably seemed to be reasonable and in order. It is entitled "Confirmation of the Important Discovery of the Property of Sulphur in Trees, to Destroy all Insects Preying on Them." The article is quoted below and in it Rafinesque claims the now doubtful honor of being the first "tree plugger" in America.

"Farmers and Gardeners ought to hail with rapture a safe, certain, easy and unfailing mode of driving away or destroying all the insects, bugs, caterpillars, lice, ants, which prey upon trees and often kill them.

"Numberless have been the means proposed or devised to get rid of these troublesome guests, most of which are dirty, costly, or unavailing. Our farmers appear to have given up in despair the hope of preventing the deadly attacks of curculios on the roots

of peach trees, and the fruits of the plumb tree. Yet an efficacious mode is said to have been found several years ago in France, perfectly efficacious and applicable to all cases and all trees. The name has not even reached us. But we claim the honor to have been the first to make known the process in America, in 1823 in Kentucky, and in 1827 in Philadelphia. Yet the most useful knowledge is so slow to spread, that the fact is hardly known yet, or doubted by those who know of it.

"We are happy to be able to publish two direct experiments in support of the fact and discovery.

"First. We bored and plugged with sulphur in the usual way, a plumb tree which commonly dropped every year all the plumbs before becoming ripe, the curculios lodging eggs in their germs. This was done when the tree was in blossom. On that year hardly any fruit fell, and the tree produced quite well.

"Second. We find in the Genesee Farmer of January 28, 1832, that a young willow nearly killed by aphis or lice, and pissmires feeding on their honey, was quite revived in three days, and all the lice and ants driven off, by boring the tree with an augur five feet from the ground and three-fourths through the diameter, filling with brimstone and plugging tight. The tree has thrived ever since.

"The *modus operandi* of this singular process is very easy to explain. The vital energy of the tree and sap, dissolves the sulphur, carries it into circulation, and evolves it in sulphuric gas evaporating through all the pores of branches, leaves and fruits. This gas is a deadly poison to insects and all animals, it suffocates them or drives them away as soon as they begin to smell it; but no injury whatever results to the tree.

"We have never heard yet of any direct experiment on peach trees; but we are sure it will answer quite as well. If the sulphuric emanation could not reach quick enough the roots of the trees which are commonly attacked; the plugging must be near the root or at the time of the descending sap, when it will sooner reach the roots. Let it be tried and the results made known. C.S.R."

The Franklin Society of Providence, R. I., published at Providence in 1829 an 8-page pamphlet entitled "General Directions

for Collecting and Preserving Articles in the Various Departments of Natural History,'' in which it is stated that beetles may be killed by immersion in spirits of wine, or hot water and also by touching their heads with spirits of turpentine or by putting them under an inverted tumbler and filling it with sulphur fumes, by means of lighted matches held under one edge. However, J. P. Kirtland, 24 years later, or in 1852, in the American Journal of Science and Arts (vol. 63, no. 38, March, p. 286–287) said that compressing the thorax, puncturing the thorax with a needle dipped into oxalic acid, killing with ether, chloroform, or sulphur fumes, were all objectionable because they impaired the beauty of the specimens and mutilated them as well. His method was to puncture the thorax once or twice with a needle dipped previously in a strong solution of potassium cyanide. He advised also that, in order to prevent oily exudations and to preserve colors, the abdominal contents should be removed and replaced by cotton. Detailed directions were given for the dissection, stuffing and sewing-up of the body.

At the annual fair of the New Haven Agricultural Society, held at New Haven, Connecticut, Mr. Noyes Darling, on October 1, 1845, gave a popular talk on the importance of knowing about insects and much of his information came from Harris's ''Insects Injurious to Vegetation.'' Darling recommended the study of insects as a part of education and said, ''If the time ever comes, as it may come, when the interference of government shall be required to stay the ravages of insects, a thorough knowledge of them will be indispensable to enlightened and well directed legislation.'' In addition, he asked, ''Why should not government make war upon cutworms and plum weevils, as well as upon barberry bushes and Canada thistles?'' Darling, who was a graduate of and a tutor in Yale, one time mayor of New Haven, a judge of the county court, and interested in horticulture and agriculture, would be amazed, were he alive today, at the entomological activities of government.

A publication called ''The Annual of Scientific Discovery'' was started, in Boston, in 1850, to record the most important discoveries and improvements in mechanics, natural philosophy, chemistry, zoology, botany, geology, etc., etc., etc. As a rule ento-

mology did not occupy much space in the Annuals, but in the one for 1851, a statement was copied from the "London Journal of Arts" about the electroplating of insects, flowers, etc., as a means of preserving them. The insects were first steeped in a solution of phosphorus and then in a solution of nitrate of silver. The phosphorus caused the silver to precipitate upon the insect and to form a very thin metallic coating over every part of it. Upon this a thicker deposit of metal was obtained by the "electrotype" process, after which two or three small holes were made through the coating and the specimen heated so as to drive off the moisture. This method of preserving insects was ignored by collectors and museums alike.

Biological control was not highly regarded at first even by some entomologists. In Brooklyn, N. Y., there appeared, in 1862, a report on "The measure worm Ennomos subsignaria; a description of the insect in all its metamorphoses, its history and progress, and a systematic plan for its final extermination, together with remarks on the state of the shade trees, in the city of Brooklyn, N. Y." This report, prepared by H. A. Graef and Edward Wiebe, was submitted to a large committee appointed by the Brooklyn Horticultural Society, which ordered its publication.

The insect in question had been a pest of Brooklyn shade trees for a number of years. In 1860 the Common Council passed a resolution "to free the city from the perpetually increasing measure worm nuisance, even by removing from our streets all trees infested by this insect." The control plan of Graef and Wiebe was extensive. It involved a mapping of the area, the scraping of all egg masses from all trees during the winter. During April, tar rings four inches wide, were to be applied to the trunks and larger branches. Such caterpillars as were found beyond the tar bands were to be removed with the foliage by means of shears. Any caterpillars escaping the operations thus far were to be syringed with a strong tobacco infusion or destroyed by daily repeated beatings or jerkings of the tree and branches with proper tools and machinery. If any caterpillars still resisted and spun cocoons then the cocoons were to be gathered and destroyed. If, after all the foregoing had been done, adults appeared they were to be caught in nets or syringed from the trees like the cater-

pillars. Such uninterrupted warfare, carried on with energy, must as a matter of course, so the authors stated, reduce the infestation considerably in a short time. In addition the cooperation of wrens was to be enlisted by the erection of cheap, useful, simple and lasting wren houses, in the city streets.

In the preparation of their report, the authors consulted entomologists and other scientific and learned persons. It was received flatteringly by almost everyone. There was, however, one exception. Dr. Trimble, of Newark, N. J., a member of the original Committee on Shade Trees, dissented. He said that it was useless to spend a single dollar, because a little "fly" was destined to do the controlling. The authors would not have mentioned this at all if Dr. Trimble had not published his adverse opinion in the "Newark Weekly Mercury," of October 14, and sent copies of this paper to most of the members of the Committee. The authors claimed that the insect had been getting worse over a period of 25 years and they did not believe that a parasite, all at once, would be able to combat an enemy so strong. As practical men, they preferred to rely on their own exertions, refusing any help from "a fanciful agency." It is not known if the measures recommended in the report were attempted or if everything was left to the parasite. Mr. H. A. Graef, one of the authors of the report, came from Aix-la-Chapelle, Germany, in 1848, and settled in what is now known as Bay Ridge, Brooklyn. He established himself as a florist and he was also interested in natural history and in collecting local plants. His son, Edward L. Graef, previous to his death, was a well-known member of the Brooklyn Entomological Society.